Stocks Near-Real-Time Data Analysis and Visualization Project

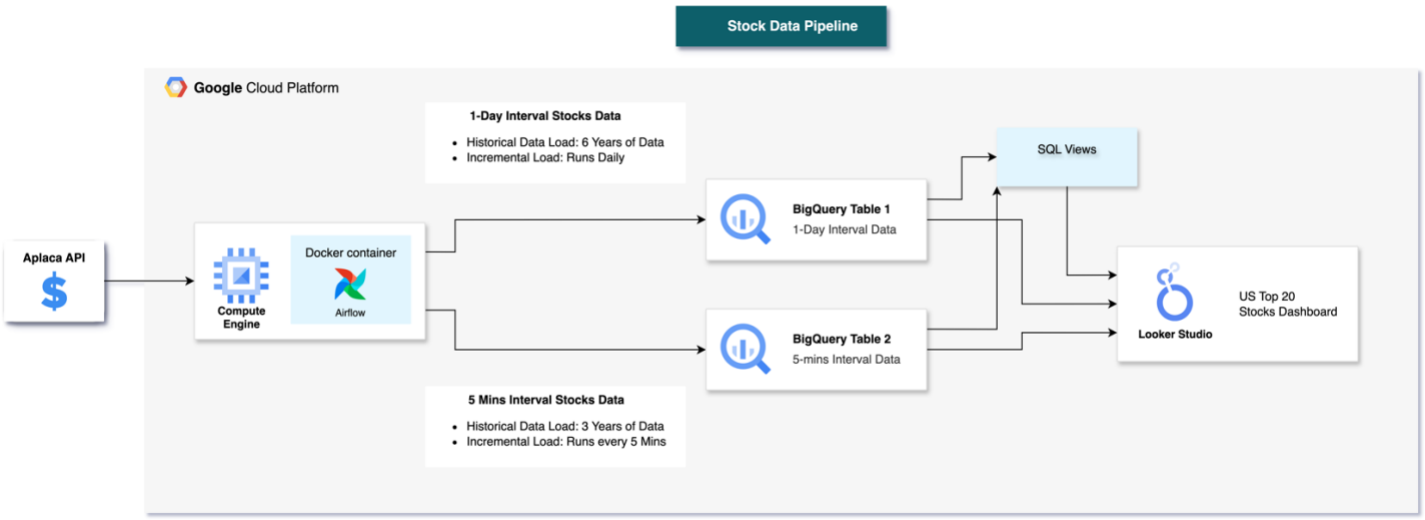
Overview

In this project, I am running ETL pipelines using Apache Airflow to collect (6 years of historical + near real-time) stock data from the Alpaca API, process it, and store it in two Google BigQuery tables:

- Table 1: Stores 1-day interval stock data (One-time ETL run + incremental ETL runs daily).
- Table 2: Stores 5-minute interval stock data (One-time ETL run + incremental ETL runs every 10 minutes).

I am using Google Cloud Engine to run Airflow in a Docker container spun up using a docker-compose file. I have connected Looker Studio to the BigQuery tables and SQL views to create different visualizations for analyzing stocks.

Architecture:



Technology Stack

- **Programming Language:** Python, SQL
- **APIs (Data Source):** Alpaca
- **Containerization:** Docker, Docker Compose
- **Database:** Google BigQuery
- **Orchestrator:** Apache Airflow
- **Data Visualization:** Looker Studio
- **Cloud Platform:** Google Cloud Platform (GCP)
- **Development Environment:** Visual Studio Code (VS Code) with “Remote Development” Extension

Aplaca API details:

- **Key:** PKAFPE8IL5495B6P4106
- **Secret:** yde2olNHNXvDSUpsJUKART2pWJ7sMeXEbz2Oe4vp

Alpha Vantage API details:

- **API key: M5DQ8BDRKJOVFU5I**

Sample output of Aplaca API : **https://data.alpaca.markets/v2/stocks/AAPL/bars**


```
{
   'bars': [
      {
         'c': 216.24,
         'h': 216.78,
         'l': 211.97,
         'n': 589469,
         'o': 212.1,
         't': '2024-08-09T04:00:00Z',
         'v': 42201646,
         'vw': 215.199872
      },

   ],
   'next_page_token': None,
   'symbol': 'AAPL'
}
```


c (Close Price): The closing price of the stock on that day.
h (High Price): The highest price reached during the trading day.
l (Low Price): The lowest price reached during the trading day.
n (Number of Trades): The number of trades executed on that day.
o (Open Price): The opening price of the stock for the day.
t (Timestamp): The date and time of the data point, in ISO 8601 format (UTC).
v (Volume): The total number of shares traded on that day.
vw (Volume Weighted Average Price): The volume-weighted average price for the day.

Infrastructure setup Process:

1. Create Google Cloud Engine instance: **minimum n2-standard-2** type (Allow ports 8080,8081,22,http)

2. **Setting Up Docker on Google Cloud Engine (Debian)**

   Install Docker:

   - sudo apt-get update
   - sudo apt-get install -y apt-transport-https ca-certificates curl software-properties-common gnupg
   - curl -fsSL https://download.docker.com/linux/ubuntu/gpg | sudo apt-key add -
   - echo "deb [arch=amd64] https://download.docker.com/linux/debian bookworm stable" | sudo tee /etc/apt/sources.list.d/docker.list > /dev/null
   - sudo apt-get update
   - sudo apt-get install -y docker-ce
   - sudo systemctl status docker
   - sudo usermod -aG docker $USER
   - newgrp docker
   - docker run hello-world
   - docker –version

   Install Docker Compose:

   - sudo curl -L "https://github.com/docker/compose/releases/download/v2.20.1/docker-compose-$(uname -s)-$(uname -m)" -o /usr/local/bin/docker-compose
   - sudo chmod +x /usr/local/bin/docker-compose
   - docker-compose –version

3. **Run Airflow on GCE using docker compose. We would need postgres for airflow metadata to be stored.**

   - Create a docker-compose.yml File:

```
version: "3.8"

services:
  postgres:
    image: postgres:latest
    container_name: postgres
    environment:
      POSTGRES_DB: airflow
```

```
      POSTGRES_USER: airflow
      POSTGRES_PASSWORD: airflow
    ports:
      - "5432:5432"
    volumes:
      - postgres_data:/var/lib/postgresql/data
    networks:
      - my_network

  airflow-init:
    image: apache/airflow:latest
    container_name: airflow_init
    environment:
      AIRFLOW__CORE__EXECUTOR: LocalExecutor
      AIRFLOW__CORE__LOAD_EXAMPLES: 'False'
      AIRFLOW__DATABASE__SQL_ALCHEMY_CONN:
postgresql+psycopg2://airflow:airflow@postgres:5432/airflow
    entrypoint: /bin/bash -c "airflow db init"
    networks:
      - my_network

  airflow-webserver:
    image: apache/airflow:latest
    container_name: airflow_webserver
    environment:
      AIRFLOW__CORE__EXECUTOR: LocalExecutor
      AIRFLOW__CORE__LOAD_EXAMPLES: 'False'
      AIRFLOW__DATABASE__SQL_ALCHEMY_CONN:
postgresql+psycopg2://airflow:airflow@postgres:5432/airflow
    ports:
      - "8081:8080"
    volumes:
      - airflow_dags:/opt/airflow/dags
      - airflow_logs:/opt/airflow/logs
      - airflow_plugins:/opt/airflow/plugins
    command: ["airflow", "webserver"]
    networks:
      - my_network
    depends_on:
      - postgres

  airflow-scheduler:
    image: apache/airflow:latest
    container_name: airflow_scheduler
```

```
    environment:
      AIRFLOW__CORE__EXECUTOR: LocalExecutor
      AIRFLOW__CORE__LOAD_EXAMPLES: 'False'
      AIRFLOW__DATABASE__SQL_ALCHEMY_CONN:
postgresql+psycopg2://airflow:airflow@postgres:5432/airflow
    volumes:
      - airflow_dags:/opt/airflow/dags
      - airflow_logs:/opt/airflow/logs
      - airflow_plugins:/opt/airflow/plugins
    command: ["airflow", "scheduler"]
    networks:
      - my_network
    depends_on:
      - postgres

volumes:
  postgres_data:
  airflow_dags:
  airflow_logs:
  airflow_plugins:

networks:
  my_network:
    driver: bridge
```

Run Docker Compose:

- docker-compose up -d
- docker-compose up –build

Verify Running Containers:

- docker ps

4. Create 2 tables on BigQuery to store the data:

- **historical_stock_prices:** Store 1-day interval stock data
- **realtime_stock_prices:** Store 5-min interval stock data

```
CREATE TABLE stocksdatacsv-433003.stocks_data.historical_stock_prices (
    symbol STRING,
    close_price FLOAT64,
    high_price FLOAT64,
```

```
    low_price FLOAT64,
    number_of_trades INT64,
    open_price FLOAT64,
    timestamp TIMESTAMP,
    volume INT64,
    volume_weighted_average_price FLOAT64
)

CREATE TABLE stocksdatacsv-433003.stocks_data.realtime_stock_prices (
    symbol STRING,
    close_price FLOAT64,
    high_price FLOAT64,
    low_price FLOAT64,
    number_of_trades INT64,
    open_price FLOAT64,
    timestamp TIMESTAMP,
    volume INT64,
    volume_weighted_average_price FLOAT64
)
```

5. **Access Airflow UI:** http://<PUBLIC_IP_of_GCE_instance>:8081/

6. **To login to Airflow, you need to create a user in Airflow:**

```
docker exec -it airflow_webserver airflow users create \
--username atul \
--firstname Atul \
--lastname Nayak \
--role Admin \
--email abc@northeastern.edu \
--password xxxxxx
```

7. **Access Airflow Container Terminal:**

- docker exec -it <container ID> /bin/bash
- docker exec -u root -it <container ID> /bin/bash (For root access)

8. **Create DAG Files in Airflow here:** /opt/airflow/dags

- Install Nano Editor (Optional):
    - apt-get update
    - apt-get install -y nano

- Create Dag file using nano in dags directory: nano pull_historic_data_dag.py

9. **Access the Dag code on airflow running in GCE using VS code:**

- Download “Remote Development” extensions on VS code
- Check from Mac CLI first, if you can access the GCE using **: ssh nayakatul1k999@<public_IP>**
- If it fails:
    - **On your Mac CLI, navigate to the SSH directory:** cd ~/.ssh
    - **Display your public key:** cat id_rsa.pub
    - **Copy the output and paste it into the GCE CLI:** nano ~/.ssh/authorized_keys

  Update Permissions on GCE:

    - chmod 600 ~/.ssh/authorized_keys
    - chmod 700 ~/.ssh

  Adjust File Ownership and Permissions on GCE instance:

    - chown nayakatul1k999:nayakatul1k999 ~/.ssh/authorized_keys
    - chown nayakatul1k999:nayakatul1k999 ~/.ssh/config
    - chown nayakatul1k999:nayakatul1k999 ~/.ssh/known_hosts
    - chmod 600 ~/.ssh/authorized_keys
    - chmod 600 ~/.ssh/config
    - chmod 644 ~/.ssh/known_hosts

  Set Up Docker Context if required:

    - docker context create some-context-label --docker "host=ssh://nayakatul1k999@<public_IP>"
    - docker context use some-context-label

- Try connecting from MAC CLI now using: **ssh nayakatul1k999@<public_IP>**
- If it is a success, it means permission is proper to connect to GCE from Mac local. Now, you can try connecting from VS code:
    - Go to >< symbol > Search “connect to host” > Add new SSH host (if not already present)
    - On MAC CLI:
        - cd ~/.ssh
        - nano config (enter GCE details like Public Ip, username etc)

```
Host stockvm
  HostName 35.192.119.86
  User nayakatul1k999
```

IdentityFile ~/.ssh/id_rsa

- **Once you have access to dag file through VS code, enter and run the dag python scripts**

    - To Save the dag scripts using VScode, you must change permission of the dag file through root airflow account in container:

        - chown root:root /opt/airflow/dags/pull_historic_stock_data_dag.py
        - chmod 666 /opt/airflow/dags/pull_historic_stock_data_dag.py

- **Make sure to create a service account on google cloud and download the service account file and store it in the airflow container (in the path: /opt/airflow/dags/), so that it can authenticate.**

    - You can use scp command to transfer the file from mac local to airflow container in GCE. Run this on MacBook CLI:

        scp ./stocksdatacsv-433003-f8dc42626436.json nayakatul1k999@34.172.94.36:/home/nayakatul1k999/

    - To transfer the file from GCE local to Airflow container, run this on GCE CLI:

        docker cp /path/to/local/stocksdatacsv-433003-f8dc42626436.json <container_id>:/opt/airflow/dags/stocksdatacsv-433003-f8dc42626436.json

- **To run the dag file on Airflow:**

    - Python dag_file_name.py
    - airflow dags list
    - airflow dags trigger dag_name
    - airflow dags test <dag_id> (for troubleshooting)

- **After this, you must see the dag running on Airflow UI.**
- **Run all the dags → Run "One-time-run" dags first**

10. Check if data is present in BigQuery

11. Create SQL views for Looker Visualizations:

- **SQL Views for both "historical" table to change time to EST and map stock symbol to real names:**

```
CREATE OR REPLACE VIEW `stocksdatacsv-
433003.stocks_data.historical_stock_prices_est` AS
SELECT
  symbol,
```

```
  CASE
    WHEN symbol = 'AAPL' THEN 'Apple Inc.'
    WHEN symbol = 'MSFT' THEN 'Microsoft Corp.'
    WHEN symbol = 'GOOGL' THEN 'Alphabet Inc.'
    WHEN symbol = 'AMZN' THEN 'Amazon.com Inc.'
    WHEN symbol = 'TSLA' THEN 'Tesla Inc.'
    WHEN symbol = 'META' THEN 'Meta Platforms Inc.'
    WHEN symbol = 'NVDA' THEN 'NVIDIA Corp.'
    WHEN symbol = 'BRK.B' THEN 'Berkshire Hathaway Inc.'
    WHEN symbol = 'JPM' THEN 'JPMorgan Chase & Co.'
    WHEN symbol = 'V' THEN 'Visa Inc.'
    WHEN symbol = 'MA' THEN 'Mastercard Inc.'
    WHEN symbol = 'WMT' THEN 'Walmart Inc.'
    WHEN symbol = 'DIS' THEN 'The Walt Disney Co.'
    WHEN symbol = 'HD' THEN 'The Home Depot Inc.'
    WHEN symbol = 'NFLX' THEN 'Netflix Inc.'
    WHEN symbol = 'PYPL' THEN 'PayPal Holdings Inc.'
    WHEN symbol = 'INTC' THEN 'Intel Corp.'
    WHEN symbol = 'CSCO' THEN 'Cisco Systems Inc.'
    WHEN symbol = 'ADBE' THEN 'Adobe Inc.'
    WHEN symbol = 'ORCL' THEN 'Oracle Corp.'
  END AS company_name,
  close_price,
  high_price,
  low_price,
  number_of_trades,
  open_price,
  DATETIME(TIMESTAMP(timestamp), 'America/New_York') AS et_datetime,
  volume,
  volume_weighted_average_price
FROM
  `stocksdatacsv-433003.stocks_data.realtime_stock_prices`
```

- **SQL View for both “realtime” table to change time to EST and map stock symbol to real names:**

```
CREATE OR REPLACE VIEW `stocksdatacsv-
433003.stocks_data.realtime_stock_prices_est` AS
SELECT
  symbol,
```

```
    CASE
      WHEN symbol = 'AAPL' THEN 'Apple Inc.'
      WHEN symbol = 'MSFT' THEN 'Microsoft Corp.'
      WHEN symbol = 'GOOGL' THEN 'Alphabet Inc.'
      WHEN symbol = 'AMZN' THEN 'Amazon.com Inc.'
      WHEN symbol = 'TSLA' THEN 'Tesla Inc.'
      WHEN symbol = 'META' THEN 'Meta Platforms Inc.'
      WHEN symbol = 'NVDA' THEN 'NVIDIA Corp.'
      WHEN symbol = 'BRK.B' THEN 'Berkshire Hathaway Inc.'
      WHEN symbol = 'JPM' THEN 'JPMorgan Chase & Co.'
      WHEN symbol = 'V' THEN 'Visa Inc.'
      WHEN symbol = 'MA' THEN 'Mastercard Inc.'
      WHEN symbol = 'WMT' THEN 'Walmart Inc.'
      WHEN symbol = 'DIS' THEN 'The Walt Disney Co.'
      WHEN symbol = 'HD' THEN 'The Home Depot Inc.'
      WHEN symbol = 'NFLX' THEN 'Netflix Inc.'
      WHEN symbol = 'PYPL' THEN 'PayPal Holdings Inc.'
      WHEN symbol = 'INTC' THEN 'Intel Corp.'
      WHEN symbol = 'CSCO' THEN 'Cisco Systems Inc.'
      WHEN symbol = 'ADBE' THEN 'Adobe Inc.'
      WHEN symbol = 'ORCL' THEN 'Oracle Corp.'
    END AS company_name,
    close_price,
    high_price,
    low_price,
    number_of_trades,
    open_price,
    DATETIME(TIMESTAMP(timestamp), 'America/New_York') AS et_datetime,
    volume,
    volume_weighted_average_price
  FROM
    `stocksdatacsv-433003.stocks_data.realtime_stock_prices`
```

- **SQL View to get latest price of stocks for scorecard on Looker:**

```
CREATE OR REPLACE VIEW `stocksdatacsv-433003.stocks_data.latest_stock_prices`
AS
WITH latest_prices AS (
  SELECT
```

```
    hsp.company_name,
    hsp.close_price,
    hsp.et_datetime
  FROM
    `stocksdatacsv-433003.stocks_data.realtime_stock_prices_est` AS hsp
  JOIN
    (
      SELECT
        company_name,
        MAX(et_datetime) AS max_timestamp
      FROM
        `stocksdatacsv-433003.stocks_data.realtime_stock_prices_est`
      GROUP BY
        company_name
    ) AS latest
  ON
    hsp.company_name = latest.company_name
    AND hsp.et_datetime = latest.max_timestamp
),
historical_prices AS (
  SELECT
    hsp.company_name,
    hsp.close_price,
    hsp.et_datetime,
    ROW_NUMBER() OVER (PARTITION BY hsp.company_name ORDER BY
hsp.et_datetime DESC) AS rn
  FROM
    `stocksdatacsv-433003.stocks_data.historical_stock_prices_est` hsp
  JOIN
    latest_prices lsp
  ON
    hsp.company_name = lsp.company_name
  WHERE
    hsp.et_datetime < lsp.et_datetime
)
SELECT
  lsp.company_name,
  lsp.close_price AS latest_close_price,
  hst.close_price AS previous_close_price
FROM
  latest_prices lsp
LEFT JOIN
  historical_prices hst
ON
```

```
lsp.company_name = hst.company_name
AND hst.rn = 1;
```

NOTE: On looker, to generate the scorecard (that shows the lastest stock price above the graph, I connect the **latest_stock_prices** view and set **latest_close_price** in metric and **previous_close_price** in comparison metric.

- **For a toggle to filter values for 1D,5D,1M,6M,1Y,3Y on looker, we need to add a parameter for :**
  - On Looker Studio > data source > Add a New Parameter:
  - Name the parameter as like “Period”
  - Set the Parameter Type to Text.
  - Provide possible values such as "1D," "5D," , "15D", "1M", "6M", "1Y", "3Y"
  - **To find Custom Query section :** Resource > Manage Added Data Source > Select the table > Edit connection > Custom Query
  - Enter this Custom SQL query there:

```
WITH data_source AS (
  SELECT
    symbol,
          company_name,
    close_price,
    high_price,
    low_price,
    number_of_trades,
    open_price,
    et_datetime,
    volume,
    volume_weighted_average_price,
    'table_1' AS table_source
  FROM
    `stocksdatacsv-433003.stocks_data.realtime_stock_prices_est`
  WHERE
    @period IN ('1D', '5D','15D')

  UNION ALL

  SELECT
    symbol,
          company_name,
```

```
    close_price,
    high_price,
    low_price,
    number_of_trades,
    open_price,
    et_datetime,
    volume,
    volume_weighted_average_price,
    'table_2' AS table_source
  FROM
    `stocksdatacsv-433003.stocks_data.historical_stock_prices_est`
  WHERE
    @period IN ('1M','6M', '1Y', '3Y', '6Y')
)

SELECT
  symbol,
    company_name,
  close_price,
  high_price,
  low_price,
  number_of_trades,
  open_price,
  et_datetime,
  volume,
  volume_weighted_average_price
FROM
  data_source
WHERE
  et_datetime BETWEEN
  CASE
    WHEN @period = '1D' THEN DATETIME_SUB((SELECT MAX(et_datetime) FROM
data_source), INTERVAL 1 DAY)
    WHEN @period = '5D' THEN DATETIME_SUB((SELECT MAX(et_datetime) FROM
data_source), INTERVAL 5 DAY)
            WHEN @period = '1M' THEN DATETIME_SUB((SELECT MAX(et_datetime)
FROM data_source), INTERVAL 15 DAY)
    WHEN @period = '1M' THEN DATETIME_SUB((SELECT MAX(et_datetime) FROM
data_source), INTERVAL 1 MONTH)
    WHEN @period = '6M' THEN DATETIME_SUB((SELECT MAX(et_datetime) FROM
data_source), INTERVAL 6 MONTH)
    WHEN @period = '1Y' THEN DATETIME_SUB((SELECT MAX(et_datetime) FROM
data_source), INTERVAL 1 YEAR)
```

```
    WHEN @period = '3Y' THEN DATETIME_SUB((SELECT MAX(et_datetime) FROM
data_source), INTERVAL 3 YEAR)
    WHEN @period = '6Y' THEN DATETIME_SUB((SELECT MAX(et_datetime) FROM
data_source), INTERVAL 6 YEAR)
    ELSE DATETIME_SUB((SELECT MAX(et_datetime) FROM data_source), INTERVAL 1
DAY) -- Default fallback
  END
  AND CURRENT_DATETIME()
```

- **Activate Necessary Parameters:** @DS_START_DATE and @DS_END_DATE parameters below the query editor.

NOTE: The above custom query uses **"realtime_stock_prices_est"** prices table for parameter '1D', '5D', '15D' and uses **"historical_stock_prices_est"** table for parameters '1m', '6m', '1Y', '3Y' based on the parameter entered by the user.

- **Custom Data Source code for latest price scorecard just above the Linechart:**

```
WITH data_source AS (
  SELECT
    symbol,
    company_name,
    close_price,
    high_price,
    low_price,
    number_of_trades,
    open_price,
    et_datetime,
    volume,
    volume_weighted_average_price,
    'table_1' AS table_source
  FROM
    `stocksdatacsv-433003.stocks_data.realtime_stock_prices_est`
  WHERE
    @period IN ('1D', '5D', '15D')

  UNION ALL

  SELECT
    symbol,
    company_name,
    close_price,
    high_price,
```

```
    low_price,
    number_of_trades,
    open_price,
    et_datetime,
    volume,
    volume_weighted_average_price,
    'table_2' AS table_source
  FROM
    `stocksdatacsv-433003.stocks_data.historical_stock_prices_est`
  WHERE
    @period IN ('1M', '6M', '1Y', '3Y', '6Y')
),

timestamped_data AS (
  SELECT
    symbol,
    company_name,
    close_price,
    high_price,
    low_price,
    number_of_trades,
    open_price,
    et_datetime,
    volume,
    volume_weighted_average_price,
    MIN(et_datetime) OVER (PARTITION BY symbol) AS min_et_datetime,
    MAX(et_datetime) OVER (PARTITION BY symbol) AS max_et_datetime
  FROM
    data_source
  WHERE
    et_datetime BETWEEN
    CASE
      WHEN @period = '1D' THEN DATETIME_SUB((SELECT MAX(et_datetime) FROM
data_source), INTERVAL 1 DAY)
      WHEN @period = '5D' THEN DATETIME_SUB((SELECT MAX(et_datetime) FROM
data_source), INTERVAL 5 DAY)
      WHEN @period = '15D' THEN DATETIME_SUB((SELECT MAX(et_datetime) FROM
data_source), INTERVAL 15 DAY)
      WHEN @period = '1M' THEN DATETIME_SUB((SELECT MAX(et_datetime) FROM
data_source), INTERVAL 1 MONTH)
      WHEN @period = '6M' THEN DATETIME_SUB((SELECT MAX(et_datetime) FROM
data_source), INTERVAL 6 MONTH)
      WHEN @period = '1Y' THEN DATETIME_SUB((SELECT MAX(et_datetime) FROM
data_source), INTERVAL 1 YEAR)
```

```
        WHEN @period = '3Y' THEN DATETIME_SUB((SELECT MAX(et_datetime) FROM
data_source), INTERVAL 3 YEAR)
        WHEN @period = '6Y' THEN DATETIME_SUB((SELECT MAX(et_datetime) FROM
data_source), INTERVAL 6 YEAR)
        ELSE DATETIME_SUB((SELECT MAX(et_datetime) FROM data_source), INTERVAL 1
DAY) -- Default fallback
      END
      AND CURRENT_DATETIME()
),

max_realtime_timestamps AS (
  SELECT
    symbol,
    MAX(et_datetime) AS max_et_datetime
  FROM
    `stocksdatacsv-433003.stocks_data.realtime_stock_prices_est`

  GROUP BY
    symbol
),

latest_realtime_data AS (
  SELECT
    r.symbol,
    r.close_price AS max_close_price
  FROM
    max_realtime_timestamps mrt
  JOIN
    `stocksdatacsv-433003.stocks_data.realtime_stock_prices_est` r
  ON
    mrt.symbol = r.symbol
    AND mrt.max_et_datetime = r.et_datetime
)

SELECT
  ts.symbol,
  ts.company_name,
  MAX(CASE WHEN ts.et_datetime = ts.min_et_datetime THEN ts.close_price END) AS
min_close_price,
  lr.max_close_price
FROM
  timestamped_data ts
LEFT JOIN
  latest_realtime_data lr
```

```
ON
  ts.symbol = lr.symbol
GROUP BY
  ts.symbol,
  ts.company_name,
  lr.max_close_price
ORDER BY
  ts.symbol;
```

NOTE: Here I have used a custom SQL query as a data source for the latest price of the stock based on the parameter user enters (1D or 1M…). The above custom query uses **"realtime_stock_prices_est"** prices table for parameter '1D', '5D', '15D' and uses **"historical_stock_prices_est"** table for parameters '1m', '6m', '1Y', '3Y' based on the parameter entered by the user. But for latest close price I am always using realtime table.

- **SQL view for top gainer, loser stocks table on Looker:**

```
CREATE OR REPLACE VIEW `stocksdatacsv-433003.stocks_data.top_gain_loser_stocks`
AS
select company_name, latest_close_price, previous_close_price,
case when(latest_close_price-previous_close_price) < 0 then (latest_close_price-
previous_close_price) end as top_losers,
case when(latest_close_price-previous_close_price) > 0 then (latest_close_price-
previous_close_price) end as top_gainers,
case when (latest_close_price-previous_close_price) < 0 then (latest_close_price-
previous_close_price)/previous_close_price*100 end as percent_loss,
case when (latest_close_price-previous_close_price) > 0 then (latest_close_price-
previous_close_price)/previous_close_price*100 end as percent_gain
from `stocksdatacsv-433003.stocks_data.latest_stock_prices`
```

- **SQL view for day range for every stock:**

```
CREATE OR REPLACE VIEW `stocksdatacsv-433003.stocks_data.day_high_low_range` AS
select company_name, Max(high_price) as max_day_price, Min(low_price) as
min_day_price from `stocksdatacsv-433003.stocks_data.realtime_stock_prices_est`
where date(et_datetime) = (select max(date(et_datetime))
                from `stocksdatacsv-433003.stocks_data.realtime_stock_prices_est`)
group by company_name
```

- **SQL view for 52 week high and low:**

```
CREATE OR REPLACE VIEW `stocksdatacsv-
433003.stocks_data.fifty_two_week_high_low` AS
SELECT company_name, MAX(high_price) AS max_52_week_price, MIN(low_price) AS
min_52_week_price
FROM `stocksdatacsv-433003.stocks_data.realtime_stock_prices_est`
WHERE date(et_datetime) BETWEEN DATE_SUB((SELECT MAX(date(et_datetime))
                    FROM `stocksdatacsv-
433003.stocks_data.realtime_stock_prices_est`), INTERVAL 52 WEEK)
                AND (SELECT MAX(date(et_datetime))
                    FROM `stocksdatacsv-
433003.stocks_data.realtime_stock_prices_est`)
GROUP BY
  company_name;
```

- **SQL view for latest volume for each stock:**

```
CREATE OR REPLACE VIEW `stocksdatacsv-433003.stocks_data.latest_stock_volumes`
AS
SELECT hsp.company_name, hsp.et_datetime, hsp.volume,
hsp.volume_weighted_average_price
FROM `stocksdatacsv-433003.stocks_data.realtime_stock_prices_est` AS hsp
JOIN (SELECT company_name, MAX(et_datetime) AS max_timestamp
    FROM `stocksdatacsv-433003.stocks_data.realtime_stock_prices_est`
    GROUP BY company_name) AS latest ON hsp.company_name = latest.company_name
AND hsp.et_datetime = latest.max_timestamp
```

Looker Visualization:

1. **Set the theme → Size 1800 x 2300**

2. **Displaying stock trend graph:**

    - Used Community visualization **line chart (by ClickInsight)**
    - Connected the line chart to **reatime_stock_prices_est** view
    - Used **"Close_price"** as metric
    - To format the date for the Community visualization line chart, I created a **calculated field** and named it **"et_1"** and used this formula:

```
FORMAT_DATETIME('%Y-%m-%d %H:%M', et_datetime)
```

- Used **“et_1”** in Axis dimension
- Used **“et_1”** in Sort and set it to ascending (for time in ascending order)

3. **For filtering the stocks names:**

    - Connected to **reatime_stock_prices_est** view.
    - Used **“drop down list”** control
    - Used **“company_name”** as the control field.

4. **To show the latest stock price for above the graph:**

    - Used scorecard chart
    - Connected a **custom data source.**
    - I created a new parameter called “Period1” but assigned the parameter ID of Period because I wanted use on parameter filter.
    - Set **max_close_price** in metric and **min_close_price** in comparison metric.

5. **To Filter trend based on "1D," "5D," "1M", "6M", "1Y", "3Y" :**

    - Used “**fixed-size list”** control
    - Added **“period”** parameter that we created in the control field.

6. **Top Gainer table:**

    - Used **Table Chart**
    - Connected **top_gain_loser_stocks** view
    - **“company_name”** in Dimension
    - **“latest_close_price”, “previous_close_price”,”top_gainers”, “percent_gain**” in Metric
    - Sort descending based on **“percent_gain”**

7. **Top Gainer table:**

    - Used **Table Chart**
    - Connected **top_gain_loser_stocks** view
    - **“company_name”** in Dimension
    - **“latest_close_price”, “previous_close_price”,”top_losers”, “percent_loss”** in Metric
    - Sort ascending based on **“percent_loss”**

8. **Day Range → Which is next to Line Chart:**

- Used **2 Scorecard chart,** one for Min and another for Max
- Connected to **day_high_low_range** view
- Set **“min_day_price”** in Metric for Min Score card
- Set **“max_day_price”** in Metric for Max Score card
- Keep the scorecards next to each other

9. **52 Week Range → Which is next to Line Chart:**

    - Used **2 Scorecard chart,** one for Min and another for Max
    - Connected to **fifty_two_week_high_low** view
    - Set **“min_52_week_price”** in Metric for Min Score card
    - Set **“max_52_week_price”** in Metric for Max Score card
    - Keep the scorecards next to each other

10. **Volume → Which is next to Line Chart:**

    - Used **a Scorecard chart**
    - Connected to **latest_stock_volumes** view
    - Set **“volume”** in Metric
    - Set **“et_datetime”** in Date Range Dimension

FYI: Common Docker commands:

Remove all containers: docker container rm -f $(docker container ls -aq)
Remove all images: docker image rm -f $(docker image ls -q)
Run docker compose file in detached mode: docker-compose up -d
Run docker compose with debug: docker-compose up --build
Stop docker compose: docker-compose down
Check docker volumes: docker volume ls
To delete all docker volumes: docker volume rm $(docker volume ls -q)
See running containers: docker ps

NOTE: To remove airflow metadata or the logs from the Postgres DB, you need to run these commands:

- psql -h postgres -U airflow -d airflow

- \dt
- SELECT * FROM dag_run LIMIT 10;
- DELETE FROM dag_run WHERE execution_date < NOW() - INTERVAL '2 days';
- VACUUM FULL dag_run;